XML

Making Interactive Communications a Reality

AN ALCATEL WHITE PAPER

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ARCHITECTS OF AN INTERNET WORLD ALCATEL

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Overview

On February 10, 2003, the Extensible Markup Language (XML) celebrated its fifth birthday. Unless you are a web developer, this would seem insignificant. However, it is very significant. Technology just for technology's sake rarely happens anymore. Today, business mangers are seeking ways to make technology work *for* the business to drive revenues, reduce costs, increase customer loyalty, provide better access, and ensure timely and collaborative use of information. XML is part of a family of technologies that will substantially change how all of us interact with data and use information.

XML makes it possible for a desktop computer's web browser to also be used as a bank loan officer's user interface to the bank's mainframe systems. XML makes it possible for two legacy computing systems to speak with each other without expensive software changes to their code. XML makes it possible for a web site to be voice aware so that customers can call in and get important services or information over any type of phone, whether it's digital, analog, or IP. XML provides the necessary structure, like grammar in a language, to enable systems and people to communicate.

Business, government, healthcare and education have been impacted by XML because it is the glue that binds the Internet, legacy computing systems, browsers and "inputs," like the human voice, together. XML enables human-to-human communications via the Web and it opens the door for human to system, system to human, and system-to-system communications as well.

Background

XML began as an effort to simplify the Standard Generalized Markup Language (SGML), which was the International Organization for Standardization's (ISO) standard for defining data vocabularies. SGML has been around since 1986 and was widely used to help businesses structure their documents. Things such as a parts catalog required vocabularies that were specific to their industries. Unfortunately, the complexity of SGML blocked widespread usage by the web community. SGML was difficult to learn and embraced only by documentation professionals.

XML emerged from SGML in a manner similar to the way the complex directory structure of X.500 gave rise to the Lightweight Directory Access Protocol (LDAP).

The challenge to produce a version of SGML that would be web friendly, and easy to learn and use while supporting a variety of applications, was taken up by the World Wide Web Consortium (W3C). The W3C formed a working group, which published XML with the goal of helping owners of information avoid being locked in to a particular vendor. This was happening frequently with attempts at electronic data interchange (EDI) and business-to-business (B2B) interactions, in which a supplier might lock retailers into customized software running on dedicated terminals over a dedicated network, all for the sake of faster inventory refresh and updates. Instead of saving money, the solution became a burden for both the supplier and its customers. What was needed was a platform that would enable similar kinds of interchange, but over the Internet and facilitated by either browsers or via completely browserless communication over an open TCP/IP infrastructure.

In a very informative set of white papers published on the W3C web site, www.w3.org, the story unfolds about how XML was published in 1998 and became part of what Frank P. Coyle calls the Three Revolutions in his book, XML, Web Services and the Data Revolution. Coyle talks about the revolutions in data, architecture, and software all focused on the holy grail of computing: universal connectivity. Gone are the large monolithic programming efforts to deliver software that did it all, which usually meant an expensive project that was behind schedule and over budget, and delivered very little of what was promised.

XML offers the promise of making monolithic software a thing of the past. XML, coupled with the Web, is an example of what Coyle calls the power of combination. HTTP, TCP/IP, and the browser are much more powerful combined than as separate technologies. Taken further, XML helps set the stage for web services such as hosted computing and applications delivered over the Internet. It is this modular approach to computing and software, driven by the explosion of the Internet, that is changing both the software and computing industries.

What is XML?

XML is a meta-language, that is, a language about languages. It allows you to describe (tag) data in such a way that the owner of this data can make documents powerful and meaningful (semantic) instead of just being presented nicely using the Hypertext Markup Language (HTML). In fact, XML looks a bit like HTML, as it makes use of tags (words bracketed by < and >) as well as attributes (name="value"). The difference is that HTML uses tags and attributes to describe how text will look in a browser. For example, <p> is a paragraph in HTML. With XML, <p> might mean price or person because XML uses tags and attributes to establish boundaries for data (delimit) and leaves the interpretation of the data up to the application that reads it. That application could be for online banking or a web based soft phone speaking to a company's telecommunications system. That's the beauty of XML. It does not care about transport, operating system, or the code driving a particular program.

XML is built on a hierarchy or tree structure. Again, the goal is to provide a language that is easy to use and can be understood by humans, yet is still processed by machine. XML comes from the document world, which is very different from the worlds of software code or databases. Below is a simple example of an XML document:

```
<?xml version="1.0"?>
  <book>
      <isbn>0-596-0058-8</isbn>
      <title>XML in a Nutshell</title>
      <author>Harold, Elloitte Rusty</author>
      <price cost="45.00"/>
  </book>
```

In the above example the `<?xml version="1.0"?>` tag identifies the beginning of an XML document and specifies the version. The `<book>` and `</book>` tags identify the beginning and end of a section. In that section there are four tags: `<isbn>`, `<title>`, `<author>`, and `<price>`. All the tags are considered XML elements and have specific values given by the attributes of the element and are organized by the hierarchy of the document. Notice how easy it is to read and understand once you get used to the different components.

The power of XML is not only in its ability to organize and format information, but in its ability to interact with the information. For instance, Frank Coyle provides an example for an online bookstore. The customer is making a request for the book *XML in a Nutshell* by Elloitte Rusty Harold. The query would look like this:

```
<query isbn= "0-596-00058-8" zipcode="75230"/>
```

The query is an XML element, while data is represented as the value of two attributes: `isbn` and `zipcode`.

The query would be sent to an XML interpreter. It can read the query and access internal information to formulate a reply that would look like this:

```
<reply time= "2 days" price="45.00"/>
```

XML also provides the ability to distinguish elements and attributes from others that have similar names through the use of namespaces. There are many titles and descriptions of goods and services, which could use the same elements and attributes. A book and a record album might have the same name. Again in Mr. Coyle's example we have:

```
Namespace                          Namespace
http://www.greatbooks.com          http://www.music.com

<book>                             <recordalbum>
<title>Deliverance</title>         <title>Deliverance</title>
</book>                            </recordalbum>
```

Meet the XML Family

In a W3C article celebrating XML's birthday, Dave Hollander and C. M. Sperberg-McQueen, two original members of the XML Working Group, describe their efforts to make XML so stripped down that it was easy to adopt and extend. Since it was so stripped down, it ***had*** to be extended. This produced a family of XML technologies, which are setting the pace for emerging web services and exciting capabilities of business-to-business and now peer-to-peer (P2P) communications.

Because the primary focus of XML is data, everything else such as display, search, formatting, etc., requires a member of the XML family. Below is a list of some of these technologies and their basic purposes:

Presentation

- Cascading style sheets (CSS)
- Extensible Hypertext Markup Language (XHTML)
- Extensible style sheet language formatting (XSL)
- VxML (Voice XML)

Data type descriptions

- Document type definitions (DTD)
- XML schema

Client / server manipulation and transformation

- XSL transformations (XSLT)
- XPath
- Xlink
- Xquery

The importance of the above alphabet soup is to emphasize the modularity of XML, which mirrors the modularity of the Web. The flux in computing architecture and the increasing need for interaction with data require a framework of parts that is easily assembled, speaks to multiple programming languages, is interchangeable, and can be reused. According to Hollander and Sperberg-McQueen, just as interchangeable parts drove the Industrial Age so will reusable information drive the Information Age.

XML in Action

There is an extended family that puts XML into action. Just when you thought you knew the immediate family, here come the uncles, aunts, and cousins. These family members help XML solve real world problems. Frank Coyle takes a novel approach by describing the use of XML in three waves.

The first wave essentially uses XML as a data description language for vertical industries such as mortgage banking or human resources. In this wave, the focus is on building up vertical industry vocabulary language, defining documents, and gaining industry consensus for B2B applications. The big push was to bring the Web into an enterprise and make data accessible via a browser. Specialized vocabularies sprang up by industry, supported by groups such as MISMO, which represents the mortgage banking industry. This vertical approach caused an explosion of XML vocabularies and led to the creation of the Organization for the Advancement of Structured Information Standards (OASIS), which tracks all of the XML initiatives underway.

In the second wave, XML moves horizontally across industry applications adding aspects of configuration and action to the vertical vocabulary languages. XML is used to describe instructions to be carried out by a processor and data is used as code driving a computer. There are four extended family members of XML that come into play here - EJB, SVG, VxML, and SMIL.

Enterprise Java Beans (EJB) is a component driven architecture that allows developers to build applications by assembling components rather than monolithic applications from the ground up. This is the modular and reusable vision of XML and it frees developers from having to write complex and difficult programs, which are hard to maintain, go quickly out of scope, and are costly overall to maintain, document, and keep current.

Scalable Vector Graphics (SVG) is used for describing two-dimensional graphics in XML. One of the biggest challenges for web developers is to present graphics consistently on different browsers. This is important because online customers can quickly become frustrated with a company's web site if their browsers do not adequately represent, display, and respond to the customers' requests. SVG provides a way to use an XML infrastructure to help deliver rich graphics and animation regardless of browser type. This helps enterprises of all types make better use of their web sites by providing a consistent and universal customer experience.

Voice XML (VxML) enables interaction with a web site using the human voice via a telephone or cell phone. VxML is a document that moves across the Internet just like any web page in response to a voice request. It enables the telephone to act as a browser by accepting voice traffic and converting it via a speech browser to an XML document. That XML document can then help respond to the request made by the telephone user and deliver the information back to the speech browser, which converts the information into a voice response.

This enables companies to leverage the investment they have made in web-based applications and content. Imagine not having to write special programs to extend existing interactive voice response (IVR) systems into the corporate web environment.

Synchronized Multimedia Integration Language (SMIL) uses XML to help with the creation of web-based interactive multimedia presentations. SMIL provides an alternative to Flash or JavaScript, which are used to control animation on browsers. This distinction is important because it provides for faster development of animation for a business's web site and does not require users to enable JavaScript in their browsers. SMIL is supported by RealPlayer, Windows Media Player, and

Adobe's SVG plug-in, so that browsers of all types can make use of animation. This opens new ways to communicate with customers.

For example, an online appliance manufacturer could provide a virtual online product tour highlighting features and functions, allowing prospective customers to enjoy a nearly three-dimensional view before making a purchasing decision.

In the third wave, XML is combined with other technologies adding new aspects of distributed computing. We have already spoken about the power of HTTP and TCP/IP. For XML to take full advantage of these and other transport protocols, we will focus on Simple Object Access Protocol (SOAP), one of the last two members of the extended family, which includes XML Remote Procedure Call (XML-RPC), the precursor of SOAP.

The basic mission of SOAP is to define an XML envelope for delivering XML content, while specifying a set of rules for servers to follow when they receive a SOAP message. Briefly, SOAP lets you move data anywhere across the Web. This capability presents a clear alternative to proprietary electronic data interchange (EDI) systems, which are used to connect partners and suppliers to each other. These networks work well internally, but require proprietary systems, terminals, and networks. For more information on SOAP: http://www.ind.alcatel.com/irc/terms/view.cfm?edit_id=71

Another alternative using the Internet was to employ a distributed object infrastructure like the Common Object Request Broker Architecture (CORBA) or Distributed Component Object Model (DCOM). While these protocols run over TCP/IP, CORBA talks only to CORBA and DCOM only to DCOM. SOAP uses the transport independence of XML and the power of combining HTTP and TCP/IP to unlock the hold of proprietary systems.

XML in the Real World

While XML sounds like an ideal platform to make the Web more useful and valuable to businesses, governments, schools, and healthcare organizations, the challenging question is, "What can I do with XML that I couldn't do before?" Russell Dyer, in an article on O'Reilly XML.com posed this question to Liam Quin, XML Activity Lead for the W3C. "There's nothing one can do in XML that one can't already do in something else, except for one thing, which is working with other people and sharing data and reusing tools," he said.

Quin gave an example of a bank having several departments, each using mainframe computers with different software written ten years ago that they really don't want to change. However, they want each department to access each other's database. It's possible to set up a web server using XML to do this. It can go off, query a database, and come back with presentable data. According to Quin, with XML, IT staff are more willing to take on this type of project because XML is easy to use and learn, whereas developing a CORBA interface for the same task would be much more difficult.

Expanding on the banking example, add the capability to access mainframe applications over the Internet using a browser, and you have online banking. Add this same capability to the desktop of banking personnel at outlying branches and you have better and more cost effective use of the bank's data infrastructure. Add VxML to the mix and you provide customers with voice access to their accounts. Who says COBOL is dead?

XML has also found its way into security issues - the hottest topic in information technology today. According to an article by Andy Dornan in the April 2003 issue of *Network Magazine*, XML-based standards are more flexible than current security technologies, allowing different cryptographic keys and algorithms to be applied to a file. XML can keep a message encrypted even as it passes through multiple servers, enabling

true end-to-end confidentiality. "XML brings security out of its hiding place deep inside the TCP/IP stack, moving it right up to the application layer," says Dornan.

OASIS has a security services technical committee working on developing XML-based technology to bridge the gap between different systems with a common security language know as the Security Assertion Markup Language (SAML). (http://www.ind.alcatel.com/irc/terms/view.cfm?edit_id=73)

XML is also finding its way into telecommunications as manufacturers are including XML-based screens on IP telephones and providing XML connectivity to enterprise PBX systems. This opens up development of voice services applications using web-based tools, which are more open and modular and can reuse other web development efforts within an enterprise.

Frank Coyle provides an example of just how comprehensive XML can be by describing the GovTalk initiative of the British government. "GovTalk uses XML as the basis for exchanging information among government systems, between the government and its citizens and businesses worldwide, and between the UK and foreign governments." This approach ensures interoperability and integration between and among systems that previously operated in a vacuum. Imagine bridging online voter registration as an option when renewing a car license and having that demographic information update the precinct map within the Voter Registration database. Link this to a mailing database and send out the renewal tabs along with an updated voter registration card.

The power of integration and interoperability is evident when hospitals can bridge pharmacy, imaging, patient charting, admissions, and other systems to build a comprehensive view of a patient. A business can make its catalog available online to field sales representatives working from a hotel room using the browser on their laptop. Adding IP Telephony to the browser is also possible using XML so that the reps can receive office calls on their laptops or control the calls from the browser using their cell phones.

Challenges

XML, SOAP, and WSDL face the challenges of speed and scalability as they ramp up to become industrial strength tools. In the *Business Communications Review* (BCR) eWeekly Issue 53, which is titled "Putting ZIP into XML," publisher Fred Knight relates the need to increase the performance of XML-based applications. He cites an article in the April 2003 issue of BCR written by James Kobielus, who covers XML and Web services for the Burton Group. "While XML holds out the promise of reducing time and money for applications development, there's a catch, and it's a big one: performance," says Knight. In Kobelius' words, XML is "bit heavy" and "text based." These issues, coupled with security features, increase processing time and bandwidth requirements, which means end users see long delays in HTML screen refreshes, according to Kobielus.

There are many approaches to speeding up XML. One method is to process XML on a separate server. Forrester says it like this, "As the volume of XML traffic between firms multiplies, the tasks of routing, parsing, and acting on traffic will overtax general-purpose processors which are sub-optimized for the task. Instead, a new generation of XML processing appliances will emerge." According to Knight, there are new companies capitalizing on XML. Sarvega (http://www.sarvega.com) builds XML specific switches, which offload complex XML processing.

Kobelius also sees IP network routers managing the XML challenge by taking on more of the functions of application data routers. Using the term "content-aware Web services routers," Kobelius says these devices will need the ability to filter, route, queue, and cache SOAP/XML content.

Frank Coyle describes building industrial strength web-based services as providing four pillars of support: messaging, transactions, security, and identity. "In the current software world, these capabilities are being

provided from two directions. One side is Microsoft's .NET, a Windows-centric framework for extending Windows-based networks into the extended space of the Web. On the other side is J2EE, a Java-centric specification that is being implemented by several companies including Sun, IBM, BEA, HP, Oracle and others," says Coyle.

The software industry is well aware of what Gordon Bell describes as a dominant platform shift every ten years. And while the vision of open computing is not new, there is no doubt that an open standard like XML, using HTTP and TCP/IP, will play a critical role with increasing support by the major software and computing players.

XML and Alcatel's Vision of Interactive Communications

Alcatel believes much of a company's competitive advantage lies in the knowledge of its workers. Knowledge has little value if it's not shared, and this is evident in any organization, whether it is healthcare, higher education, or government oriented. Knowledge and information within an organization, when combined and easily accessed, can accelerate product development, ensure patient safety, provide distance learning, and connect citizens to critical government services.

Interactive communications relies on an open suite of standards-based tools and Alcatel is incorporating technologies such as XML, VxML, SOAP, WDDI, J2B, and WSDL into our communications platforms and applications. These enable connections to multiple enterprise applications such as email, web servers, human resources, voice services, etc. The goal is to enable workers to manage calls, personal information, email, voice mail, and remote communication, and access company databases and services through a web-based interface. This interface could be on a PC, PDA, cell phone, or telephone.

There are many applications for interactive communications that can help save money and keep employees and customers connected. For example, an employee working from home can use an Alcatel XML web-based soft phone to control a home phone for accessing corporate directories or making phone calls. If the network speed to the home is high enough, the voice connection can be over IP. A doctor can use the same web based soft phone on a wireless mobile device, such as a palm or pocket PC, which also provides access to directories and patient information. The XML web phone may control a wireless phone carried by the doctor, or if the palm device is voice ready, the web phone can provide connectivity using VoIP.

With easy database access, calls are easily screened and calendars are available for appointment and meeting planning. Email, voicemail, and text messaging can be combined on the same interface. Imagine using a wireless PDA or pocket PC to set up a conference call at a remote location just by entering the phone number at that location while accessing the conference functions and directories from a corporate server via the PDA.

With the powerful OmniPCX Enterprise IP Communications platform, organizations are able to voice enable their web services by integrating their web environment. Using the Alcatel XML, a customized browser-based soft phone can be developed that is considered an extension within an organization's OmniPCX dial plan. It provides a basic set of features using an Open Telephony Server connected over IP to the PCX. The benefit of XML Telephony is that it works on multiple platforms (Windows, MAC, Linux, UNIX) using an XML/SOAP interface. It can be used with Java or Microsoft COM / DCOM technology.

Similarly, a business could integrate controls for employees' desktop telephones (e.g., make-call, conference, transfer) into existing web-based applications. This is, of course, similar to what could be done previously with traditional CTI interfaces and programming languages. The difference is that this is done using a development environment that is web-based and would be familiar to any web-developer. This cuts the development effort dramatically, making such integration realistic and affordable across the enterprise.

Finally, Alcatel, through its carrier business, is building a voice web platform for service providers to help them gain access to the enterprise market. This platform binds business applications to voice processing using XML. This means a service provider can offer hosted voice services such as web-enabled interactive voice response (IVR) or interact with a customer's premises voice system to add value by augmenting call routing or co-developing other solutions.

Conclusion

It has been said the Internet has forced us to look out instead of in, which is true. Organizations now seek ways to present themselves to prospective customers, to citizens, to students, and to the world via the web and browser technology. Business and technology leaders also agree that most of the issues facing an enterprise are now on the edge. Connecting core business processes with your business partners, or at the other end, your sales channel is where the focus must be, according to the July 2002 *Harvard Management Update*.

This will require a view of the enterprise that is more global and not focused on specific applications, programs, and computing platforms. It means having the ability to link legacy programs written in languages like COBOL to a customer who is in an airport with a cell phone. It means linking legacy systems to each other even with tight IT budgets. It means leveraging existing investments to continue to extend the reach of a company's knowledge or build better patient profiles, bring citizens closer to government, and teach in environments outside the traditional classroom.

XML opens the door for the interactive communications that make all of this possible. Robert Metcalf, who invented Ethernet, likes to talk about the chemistry of the Web, how many parts come together with fascinating "chemical" reactions. He sees the Web based on XML, but more importantly, it will be about linking information not for human consumption, but structured for processing by software. Metcalf goes on to say, "Still my guess is that the next big Web will be something more - something that we haven't thought of yet or that Tim Berners-Lee hasn't thought of yet, and because that's the way it usually goes with the Web."

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Glossary

B2B	Business to business
CSS	Cascading style sheets
CHTML	Compact Hypertext Markup Language
COBOL	Common Business Oriented Language
CORBA	Common object request broker architecture
CRM	Customer relationship management
CTI	Computer telephony integration
DTD	Document type definitions
DTMF	Dual tone multi-frequency
EDI	Electronic data interchange
EJB	Enterprise Java beans
HTML	Hypertext markup language
HTTP	Hypertext transfer protocol
ISO	International standards organization
IVR	Interactive voice response
J2B	Java to business
J2EE	Java to platform, enterprise edition
LDAP	Lightweight directory access protocol
OASIS	Organization for the advancement of structured information standards
PC	Personal computer
PDA	Personal digital assistant
RPC	Remote procedure call
SALT	Speech application language tags
SAML	Security Assertion Markup Language
SMIL	Synchronized Multimedia Integration Language
SOAP	Simple Object Access Protocol
SGML	Standard Generalized Markup Language
SVG	Scalable vector graphics
TCP/IP	Transmission Control Protocol/Internet Protocol
VxML	Voice Extensible Markup Language
W3C	World Wide Web consortium
WDDI	Winpath Device Driver Interface
WSDL	Web Services Description Language
WML	Web Site Meta Language
XHTML	Extensible Hypertext Markup Language
XML	Extensible Markup Language
XSL	Extensible style sheet language formatting
XSLT	XSL transformations

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